Missouri Forest Pest Report 1990

Missouri Department of Conservation

Forestry Division

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Missouri Department of Conservation
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Introduction

The 1990 growing season was exceptionally wet, particularly in the spring and early summer. The above normal precipitation provided excellent growing conditions for most forest and shade trees.

Extreme low temperatures in late December 1989, however, damaged a number of shade tree species. The injury was apparent after leaf flush on sweetgum, magnolia, mimosa, privet, mulberry, bald cypress and other species on the northern edge of their range. Winter burn on conifers and other evergreens was also prevalent in the northern part of the state.

Spring brought wet weather and with it excellent conditions for infection by leaf disease fungi. Sycamore anthracnose was severe statewide and prompted numerous calls from individuals concerned about the health of their trees. Quince rust on hawthorne, and apple scab on crabapples were also severe in the early part of the growing season. On conifers, Diplodia tip blight increased dramatically, and conditions were excellent for brown spot needle blight infection of Scotch pine. For early season insects, eastern tent caterpillar populations escalated on Prunus species, although European pine sawfly populations collapsed and the insect only caused minor damage this year.

In early summer, walnut caterpillar increased statewide and caused significant defoliation of eastern black walnut. The defoliation started in early July and many trees were stripped of their leaves by the latter part of the month. Fall webworm followed the walnut caterpillar outbreak and was heavy on a number of hardwood species. Trees in the southwest part of the state were the most heavily infested. Damage from both these pests is cyclic and populations are expected to collapse in the future.

Despite adequate rainfall for most of the growing season many trees continued to die in woodlands and in landscape plantings. Most of the mortality is attributed to the drought of 1988 and invasion of drought stressed trees by secondary insects and diseases. Oaks and hickories were the main species affected. Cytospora canker on ornamental blue spruce was also common. Mortality due to periods of drought often appears two to three years post the drought event.

The season ended with the rains continuing and leaf disease fungi also continuing to cause damage. Actinopelte leaf spot on oak, leaf diseases on hickory, and anthracnose on walnut caused premature browning and leaf drop on many trees.

Requests for training in tree problem diagnosis and identification of tree problems continue to increase each year. Over 550 individuals in the tree care industry were trained in five pest management seminars this year.

We continued to put emphasis on the survey and detection of forest pests in 1990. Surveys were conducted for pine wilt disease of scotch pine, dogwood anthracnose, ash yellows of green and white ash, and for diseases of shortleaf pine. Monitoring for gypsy moth, which continued with the help of the Department, trapped only eight moths in the state. The results of these surveys and our observations on trends in pest populations are provided in this report.

Conditions in Brief

Forest Insects

Eastern Tent Caterpillar - populations were heavy in south Missouri on eastern black cherry.

European Pine Sawfly - occurred in moderate to heavy number on Scotch and mugo pines this spring in scattered locations in north, east-central and west-central Missouri.

Fall Webworm - defoliation was extremely heavy in almost every county of the state. Many tree species other than the typical walnut, hickory and persimmon were defoliated by early September.

Miscellaneous Defoliators - such as the variable oak leaf caterpillar, pale tussock moth, royal walnut moth, skiff caterpillar, hag moth, imperial moth and other *Datana* caterpillars appeared in unusually large numbers. The dogwood sawfly also defoliated rough and redozier dogwood shrubs in several counties.

Walnut Caterpillar *(Datana)* - defcliation was very heavy in 1990. Many walnut and hickory trees were completely defoliated.

Forest Diseases

Actinopelte leaf spot- on pin and other oaks caused premature browning and defoliation on many oaks late in the growing season.

Apple Scab- prematurely defoliated susceptible crabapple cultivars by the end of July.

Ash Yellows- was identified on green ash for the first time in the State. A survey found that the disease is widespread on white and green ash in Missouri.

Atropellis Canker- of shortleaf pine was found to be a common cause of branch tip dieback on trees in the Ozark.

Comandra Rust- was found to have a limited in distribution on shortleaf pine in the Ozarks. The disease was found in Dent county in the Ozarks.

Diplodia Tip Blight- infection increased significantly on Austrian pine this year. New shoot tip infections were common on pines in landscape plantings.

Dogwood Anthracnose- was not identified on flowering dogwood although Septoria leaf spot, spot anthracnose and infection by Botrytis was common.

Dutch Elm Disease- killed numerous trees in landscape plantings and in forest and hedgerows stands.

Fire Blight- infection of rose family hosts decreased in comparison to previous year's disease levels.

Foliar Diseases- caused by fungal pathogens were common on a wide range of hardwood hosts. Leaf browning and premature defoliation were prevalent due to the infections.

Frost Damage- was minimal this year except for scattered areas in the Ozarks.

Oak Decline- continued to kill oaks in both forest and landscape plantings but at reduced levels this year.

Oak Wilt- was active in northern Missouri causing pockets of mortality of red and pin oak.

Quince Rust- caused branch tip dieback and fruit infection on hawthorne around the state.

Sycamore Anthracnose- infection was heavy this spring with many trees failing to leaf out until late spring.

Winter Injury- appeared in the spring after leaf flush on trees on the northern edge of their range such as sweetgum, magnolia and mimosa.

The Program

In 1962, a cooperative program, the Forest Pest Control Program, was entered into with the U.S. Forest Service by the Forestry Division, Missouri Department of Conservation. Under the original agreement the effort is designed to detect, evaluate and control forest insects and diseases on state and private land. Department foresters and other personnel report occurrences of damaging insects and diseases. A forest entomologist and forest pathologist coordinate the program.

Insects, diseases, drought and other predisposing factors can cause damage to trees and shrubs which may be unnoticed until mortality occurs. Tree losses occur on an annual basis in the forest from hardwood

borers and defoliators, pine cambial feeders, root rot, canker and stem diseases, drought and overmaturity.

Trees under stress were vulnerable to attack by insect borers, and a host of canker fungi and root rot fungi. Some factors which stress trees are drought, compacted soil, root disturbance, lightning strikes, insufficient soil elements, and wet or dry soil conditions to list just a few. Maintaining tree vigor is the most important consideration to ensuring a long life.

Projects

The cooperative team effort of Department foresters and Forestry Division staff specialists resulted in a well coordinated, successful Forest Pest Management Program in 1990. Over 3,600 shade and forest tree requests were serviced statewide in 1990. The services of staff specialists were available to foresters and others. In February and May, four Tree Care Seminars were held in St. Louis, Kansas City, Cape Girardeau, and Springfield for foresters, Assistant Resource Foresters and personnel associated with the green industry. Over 560 people attended these four seminars.

Department foresters and staff specialists serviced over 3,300 pest related telephone calls. Over 1,500 diagnoses of tree problems were made for the state. Forest pest management specialists and district foresters presented technical sessions to arborists at regional technical seminars and conferences.

Gass and Luley conducted detection and evaluation surveys on major insect and disease problems in 1990 on 5,000,000 acres. Reports were prepared and submitted to the U.S. Forest Service.

Over 20 Plant Clinics were conducted in the St. Louis, Kansas City and Union areas to serve the public in assisting them with their tree and shrub questions. A total of six Forest Insect and Disease Status Reports (April through September) were prepared and sent to all Missouri Christmas Tree Producers, most Department personnel, and other individuals involved in tree care, totaling 1,750 copies per month. Gass and Luley attended the annual State Cooperators Meeting hosted by the U.S. Forest Service in St. Paul, Minnesota in March. Luley attended the 1990 American Phytopathological Society Conference in Grand Rapids, Michigan.

We completed our ninth season with the Integrated Pest Management Program (IPM) with the University of Missouri-Columbia. This multi-state reporting program has been developed to collect and computerize pest occurrence data for most economic plant pests in the state. Forestry

Division is reporting results to the IPM Program for incidence of insects and disease on forest and ornamental trees.

Administrative Studies

Luley established foliar disease control plots on black walnut seedlings at the George O. White State Nursery. The experiment evaluated various spray schedules using the fungicide Benlate. Studies on the impact of foliar disease control in the nursery on outplanting growth and survival were continued. A plantation was established near Stockton with seedlings that had received various fungicide treatment last year.

A second experiment on black walnut evaluated a number of fungicides for control of root rot at the nursery. The fungicides Subdue, Aliette, and Truban were applied to both undercut beds and beds that were not undercut.

A survey for ash yellows disease of green and white ash was conducted in cooperation with the Forest Service. The survey determined the presence or absence of the causal agent of ash yellows, evaluated each stand for ash yellows symptoms and for other diseases of ash. Ten stands each of green and white ash were surveyed.

Other surveys conducted in 1990 were a survey of scotch pine for pine wilt disease, survey of flowering dogwoods for dogwood anthracnose, and a survey of young shortleaf pine plantations for commandra rust and other diseases of shortleaf pine.

A number of cooperative projects with the University of Missouri- Columbia involving pest management were funded in 1990. Two continuing projects with Dr. Marc Linit have been studying the transmission of the pinewood nematode to scotch pine by the vector Monochamus carolinensis, and black walnut nut loss caused by the walnut curculio. Dr. Linit is also studying the impact of defoliators of oak and the predators and parasites of these defoliators. This project is a part of a larger project which funded through the University and is focusing on the survey and detection, etiology and management of oak decline in the Ozarks.

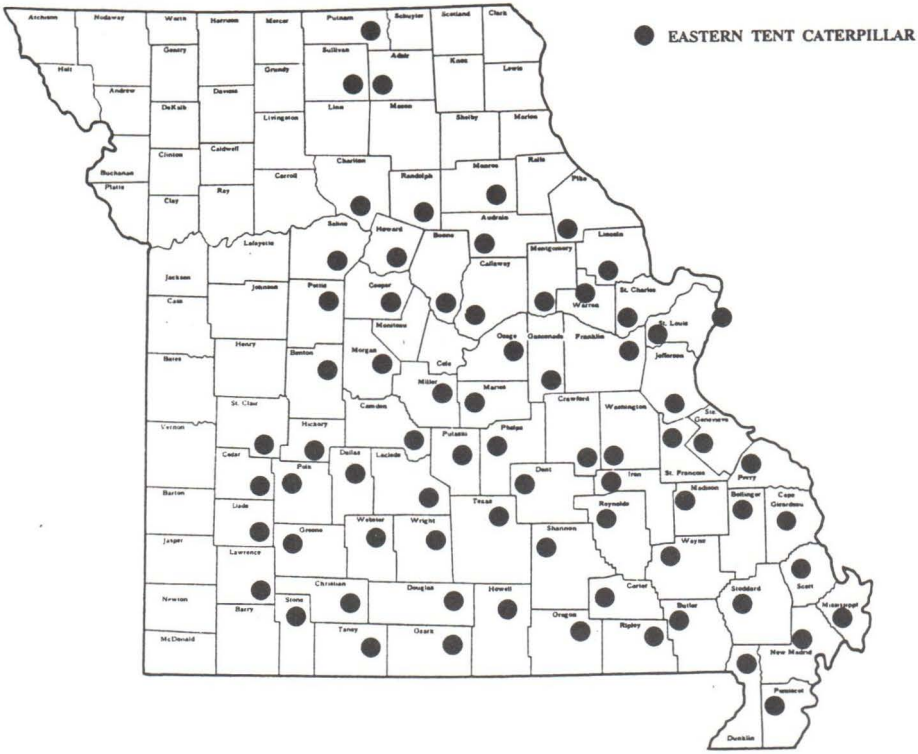
Forest and Shade Tree Insects

Hardwood Defoliators

Aphids and Lace Bug - populations were moderate to heavy on hardwood foliage statewide in late summer. Mottled leaves and molding honeydew was evident on leaves causing concerns from the public. Infestation was noticeable on walnut with many leaves dropping prematurely.

Trend - populations should be light to moderate in 1991.

Suppression - individual owners had their trees sprayed by arborists.



Eastern Tent Caterpillar - populations were heavy this spring where black cherry grows. Defoliation was complete on many trees with eight to ten webs per tree.

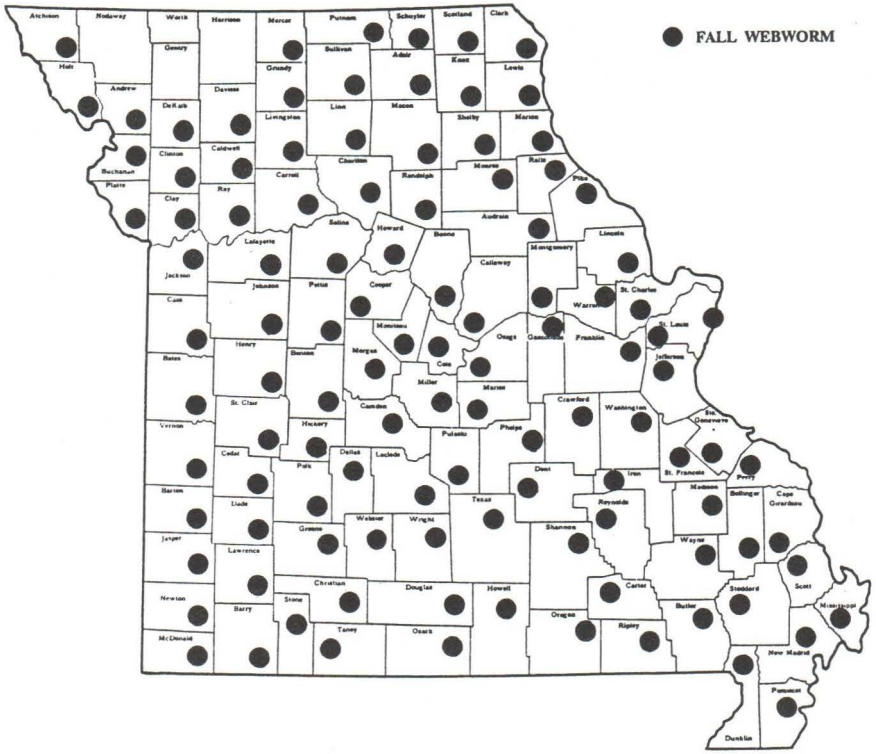
Trend - populations should be heavy in 1991.

Suppression - no control was carried out in 1990.

Fall Webworm - populations were heavy over most of the state in 1990. Webbing on black walnut, pecan, hickory, persimmon and redbud were common. Also defoliated in 1990 were fruit trees and other hardwood species.

Trend - populations should be heavy in 1991.

Suppression - various walnut and pecan growers sprayed their trees to control this insect.



Gall Insects - generated numerous reports statewide in 1990. Gall insects such as flies, wasps, psyllid gall insects and mites are active in spring. These insects lay their eggs in succulent leaf or twig tissue where the swollen parts eventually develop. Galls commonly observed are on hackberry, hickory, pin oak, bur oak, hard maple and silver maple. Elm and walnut leaves also have galls in early summer. Woody stem galls are common on pin and shingle oak.

Trend - insect gall infestation is a part of nature. We will always have gall insect development with cyclical fluctuations. Galls will always be difficult to control.

Suppression - no control was conducted for gall insects in 1990.

Green Striped Maple Worm - was heavy on silver maple tree foliage in west-central Missouri in 1990.

Trend - populations will grow in size in 1991 and cause increased defoliation of silver maple.

Suppression - no suppression activities were carried out in 1990.

Gypsy Moth - during the summer of 1990, the gypsy moth defoliated millions of acres of forest land in the northeastern United States. Spot infestations still remain in several states while the infested range continued to grow in central Michigan.

Personnel of the Missouri Department of Agriculture trapped eight male moths in St. Louis County, and Crawford County. To date, no spot infestations have been discovered in Missouri.

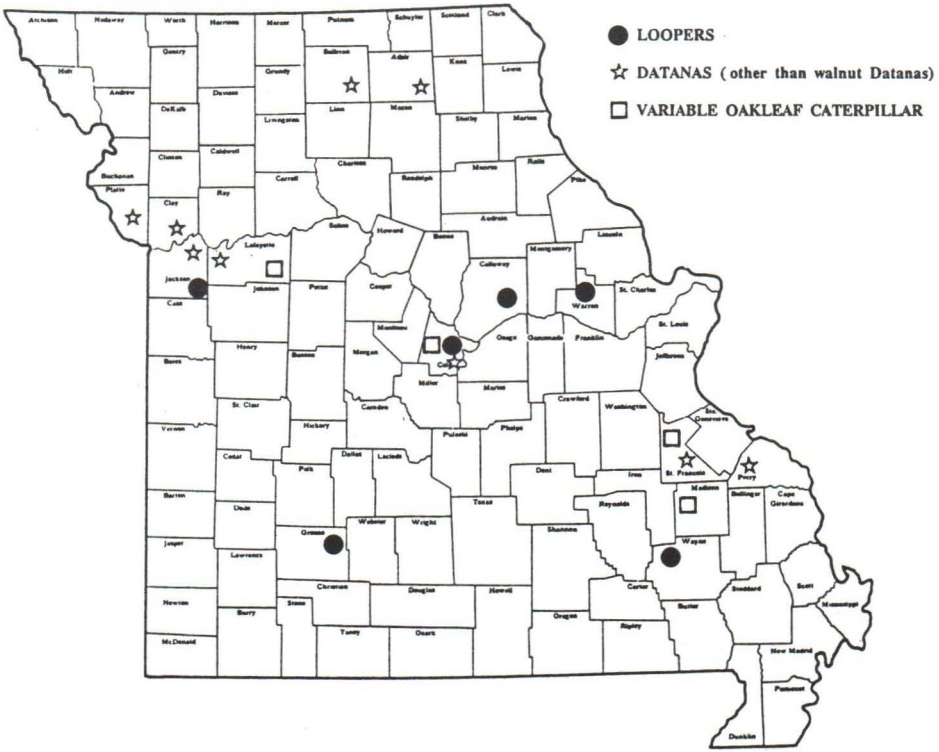
In 1990, 7,432 gypsy moth pheromone traps were placed in 61 counties by U.S.D.A., A.P.H.I.S., P.P.Q. and personnel of the Missouri Department of Agriculture Plant Industry Division. The Missouri Department of Conservation funded three summer positions to locate and monitor traps in St. Louis, Carter, Madison, Reynolds and Wayne Counties. Other cooperating groups were the Department of Natural Resources, State Parks and Historic Preservation, National Campers and Hikers Association, Corps of Engineers and John Grinstead at Ft. Leonard Wood.

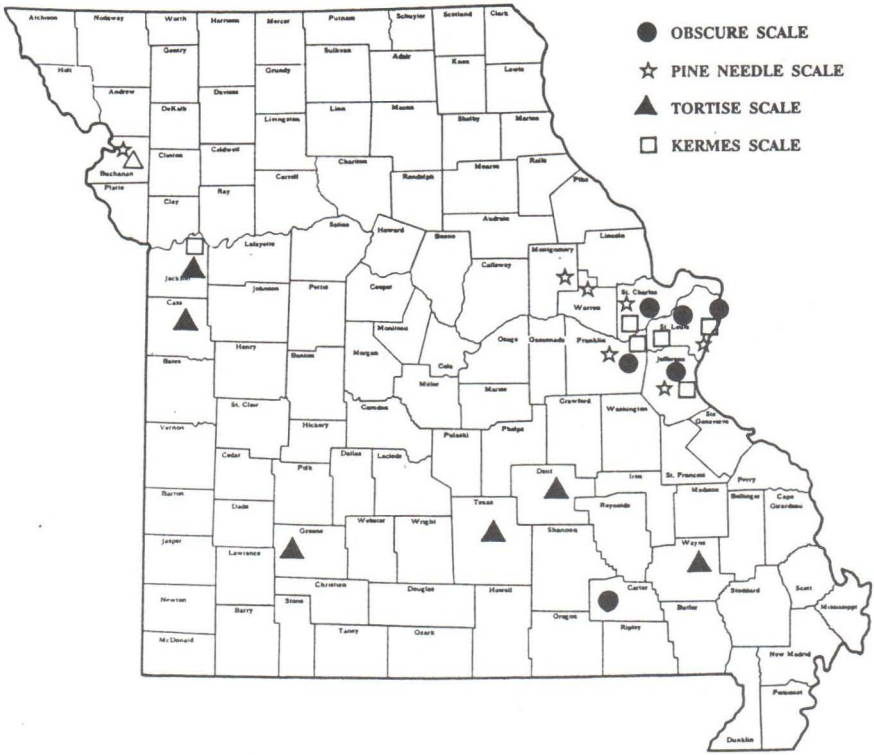
The gypsy moth isn't native to the United States, however its life cycle does parallel that of a number of other native insects. Gypsy moth larvae feed in spring and early summer on a variety of hardwood foliage. With three repeated defoliations of hardwoods, tree mortality can occur. One defoliation can kill evergreen trees such as pine or cedar.

Looper Complex - defoliation was light to moderate over the state in 1990. The term, looper complex, is used to describe at least five different insects which emerge and feed on a variety of hardwood foliage at the same time of the year. Common loopers are the linden looper, elm spanworm, spring cankerworm, leaf roller and leaf tier. It may take two to three years for looper complex to build to a high level. Predators and parasites usually are responsible for the collapse of large populations of the looper complex.

Trend - 1991 population levels should be moderate in most sections of the state.

Suppression - no suppression work was done in 1990.





Scale Insects - as a group infest a variety of hardwood trees throughout the state. These are more common on ornamental hardwood trees such as pin oak, Euonymus, and white and post oak. Some of the scales which were reported during 1990 were the obscure scale on pin oak, Euonymus scale on Euonymus, and Kermes scale on white and post oak. The most devastating scale is the obscure scale which infests pin oak, weakening it and causing decline and mortality.

Trend - scale insects will continue to cause decline on stressed hardwood trees. Scale populations will fluctuate on some trees species depending upon its life cycle.

Suppression - arborists use dormant oil, and an approved insecticide to control the crawler stage of the scale in spring.

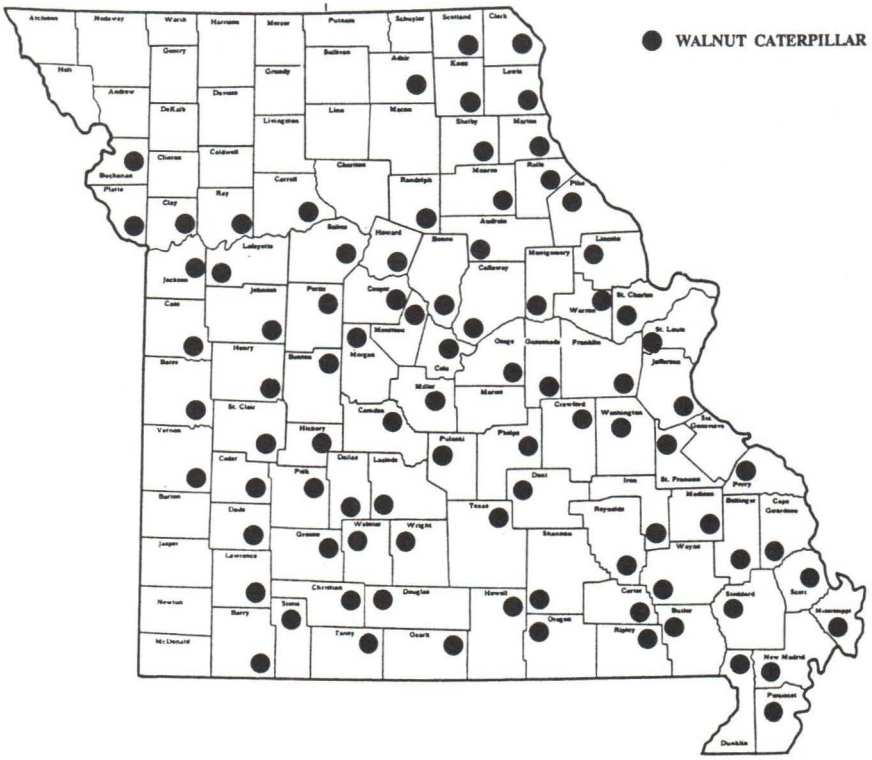
True Tree Grasshopper - was not reported during 1990.

Variable Oak Leaf Caterpillar - populations were light and being reported from four counties during 1990. The variable oak leaf caterpillar

has a capacity to defoliate thousands of acres of hardwood trees in late summer. A case in point is the heavy defoliation during 1969-1971.

Trend - populations could increase in 1991. Although defoliation does occur in late summer it does not affect the vigor of defoliated trees.

Suppression - no suppression work was conducted in 1990.



Walnut Caterpillar - populations were heavy over the entire state on black walnut, pecan and hickory. Leaf feeding begins in late June and ends in late September. Other Datana species feed on red oak, post oak, sumac and huckleberry.

Trend - populations will be heavy in 1991 in most areas of the state.

Suppression - a number of nut growers sprayed their trees as did private tree owners for this insect with approved insecticides. Numerous telephone calls were generated as a result of this infestation.

Yellownecked Caterpillar - populations grew in 1990 in eight counties. Heavy defoliation occurred on a variety of hardwood species over the state.

Trend - populations will increase in 1991.

Suppression - few tree owners had their trees sprayed with an approved insecticide.

Hardwood Borers

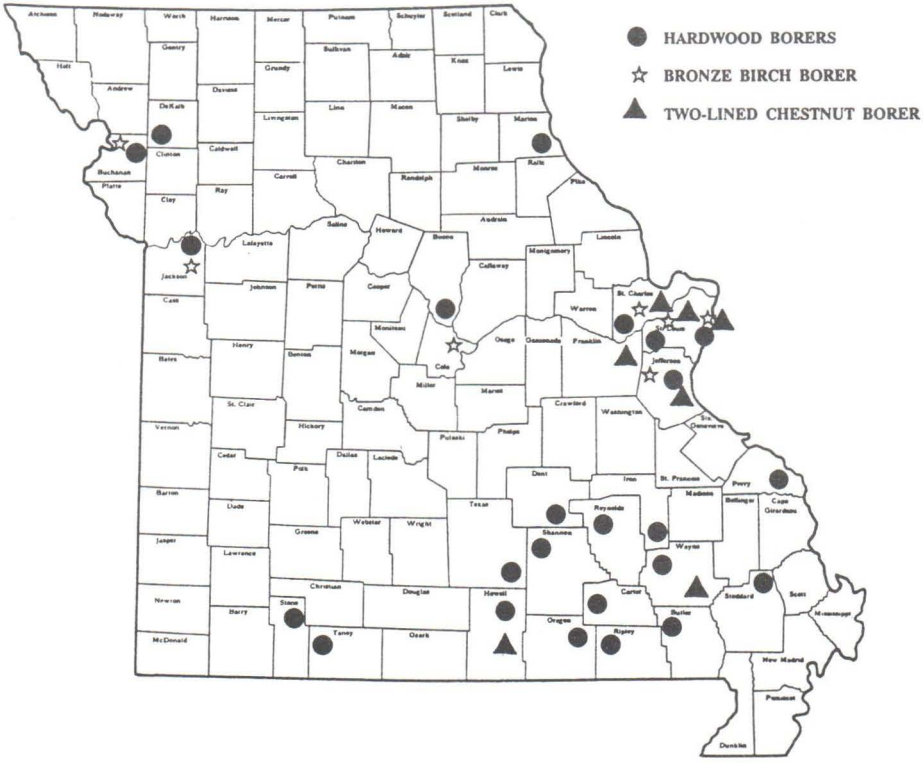
Bronze Birch Borer - populations continue to infest stressed white birch over the state causing extensive mortality. The insect is attracted to white birch wherever it grows.

Trend - stressed white birch will continue to die as a result of the stress factor which is usually drought and from the bronze birch borer infestation.

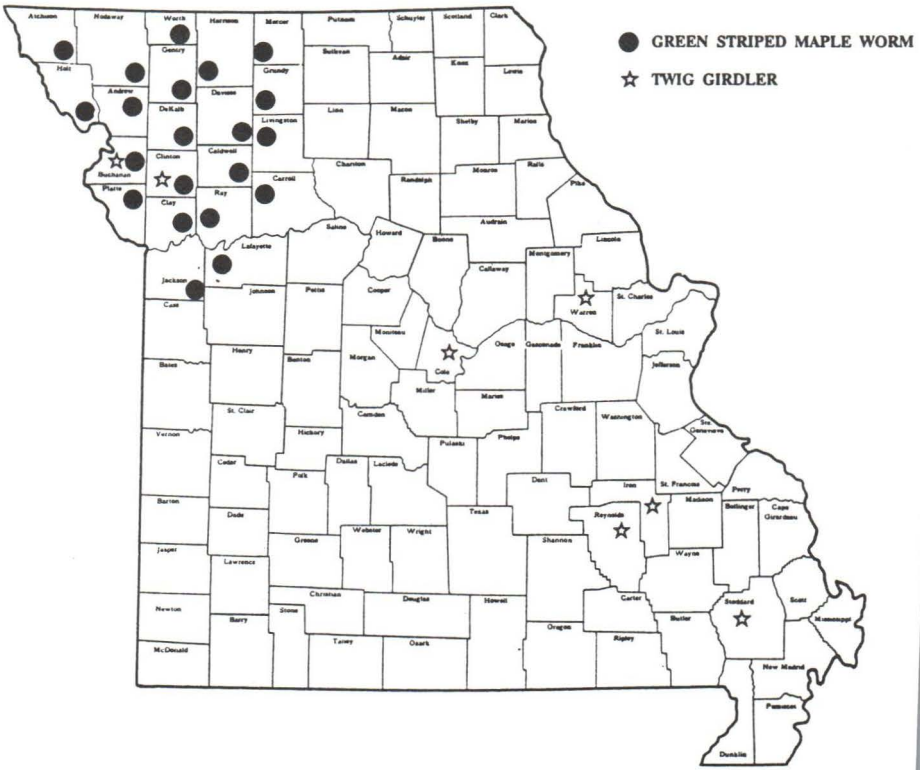
Suppression - a number of owners spray or have arborists spray their white birch trees. An effort is being made to acquaint nurserymen and landowners with our native river birch as a substitute for white birch.

The Carpenterworm and Red Oak Borer - and other living tree hardwood borers as part of our endemic, indigenous borer populations continue to infest hardwood trees in our forested and urban areas of the state. Hardwood borers are a major problem on many newly planted and smaller caliper sized hardwood trees in urban areas.

Trend - borer infestation will continue in hardwood trees occupying poor sites. Estimated dollar loss to the hardwood borer complex amount to $3,500,000 annually through lumber degrade and ornamental tree loss.



Suppression - selective tree harvest, sanitation harvest and stand conversion from low quality hardwood to pine were conducted in forested areas over the state. Some shade tree owners controlled borer infestations on high value trees.



The Cottonwood Twig Borer, Cottonwood Borer, Cottonwood Leaf Beetle and Poplar Tent Maker - all pests of eastern cottonwood continue to infest cottonwood where it grows. Borer damage is greater in trees growing on sites not suited to growing cottonwood. Defoliation by the Poplar Tent Maker occurs also everywhere cottonwood grows.

Trend - no increase in infestation is expected in 1991.

Two-Lined Chestnut Borer - is a secondary attacking insect of stressed oak trees. It plays a role in killing trees along with various root rots. In 1980, 1983, 1984 and 1988 drought conditions prevailed from late June through September over most of the state. As a result of the affects of drought, many more oak trees were lost. Other stressing factors are late frosts, poor sites and spring defoliators.

Trend - drought periods alternate in cycles of ten to fifteen years. Trees presently dying were stressed in earlier years and are just now affected. No new mortality is occurring as a result of recent weather conditions. Trees are continually dying in the forest as part of the natural succession of a maturing forest. Drought when present, along with other factors will always play a role in tree mortality.

Suppression - drought hazard sites must be identified by the forester and managed in such a manner as to consider species composition. Where hardwood basal area is too low, alternatives such as even-aged management or pine conversion should be considered within the shortleaf pine range. On droughty, poorer hardwood sites the entomological and pathological rotation should be applied rather than a fixed rotation age.

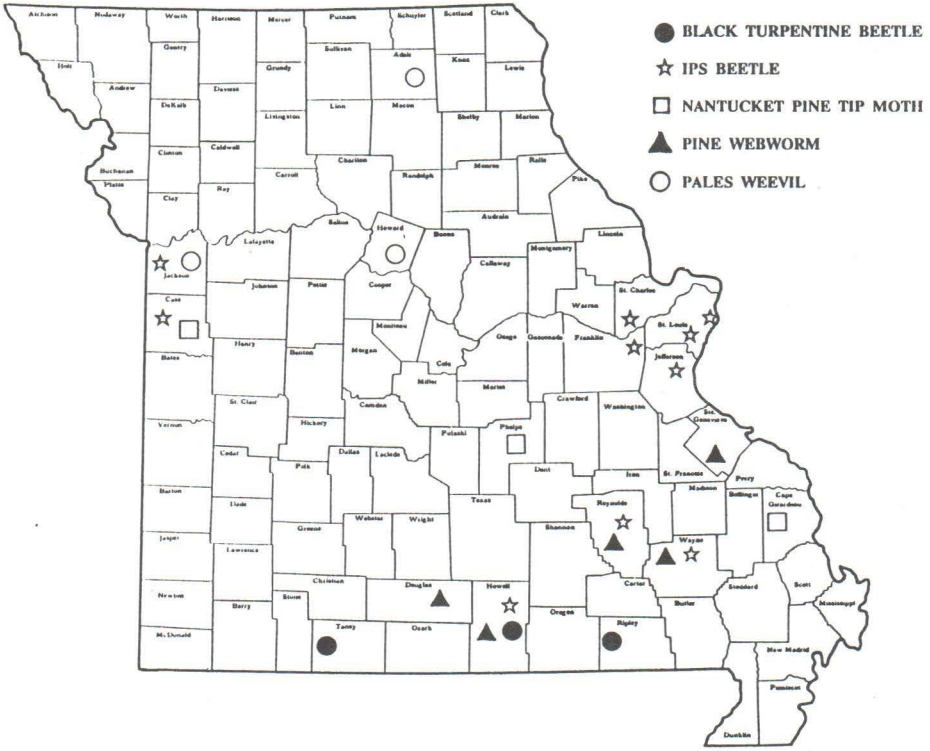
Pine and Cedar Trunk Borer, Twig Borers and Defoliators

Black Turpentine Beetle - light infestations were reported in Howell, Shannon, Ripley and Taney Counties. The black turpentine beetle infests weakened shortleaf pine trees that were damaged in a timber sale, damaged during building construction, wind thrown or those struck by lightning. Once the infestation has proceeded and is successful, the Ips beetle can also develop and complete the process of killing the tree.

Trend - beetle populations will develop where shortleaf pine trees are disturbed either naturally or artificially.

Suppression - where economically feasible, attacked trees are removed as timber cutting progresses in timber sale areas.

Ips Beetle - is a weak attacker of live, healthy shortleaf pine trees. It will also attack Scotch, jack, Virginia and Austrian pines. It is most usually detected on very stressed pines and pines that have infestations of black turpentine beetle. If new pine slash is created Ips often infests this slash and might later infest live, healthy neighboring pine trees. Ips was reported from fifteen counties although, very likely, pines in additional counties were infested. Ips has been infesting white and Scotch pines in the St. Louis and Kansas City areas.



Evergreen Bagworm - infestations of bagworms were light to moderate on upright pfitzer junipers and eastern redcedar over the state. Frequent defoliation of infested plants can lead to death over a two-to-three-year period.

Trend - bagworms will continue to threaten unsprayed ornamental evergreens. Populations are expected to be light to moderate statewide in 1991.

Suppression - some owners of evergreens had their shrubs sprayed by tree service companies.

European Pine Sawfly - populations were moderate to heavy on Scotch and mugo pine plantings primarily in north Missouri. Reports were submitted for 26 counties where heavy defoliation was observed. Affected trees are grown for Christmas trees and ornamental purposes. The larvae are spring and early summer defoliators.

Trend - populations will be heavy in 1991.

Suppression - a number of Christmas tree producers and homeowners sprayed their plants where this insect was a threat.

Loblolly Pine Sawfly - was not reported in 1990.

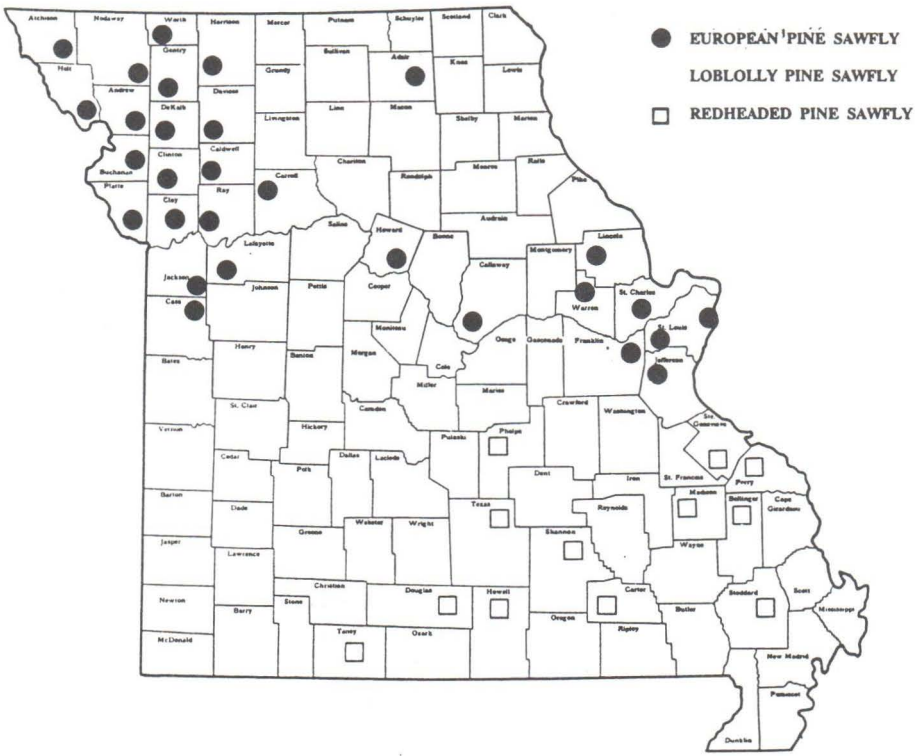
Redheaded Pine Sawfly - populations were light to moderate in 1990 being reported from twelve counties. Redheaded pine sawfly larvae feed on shortleaf and Scotch pines primarily in the sapling stage.

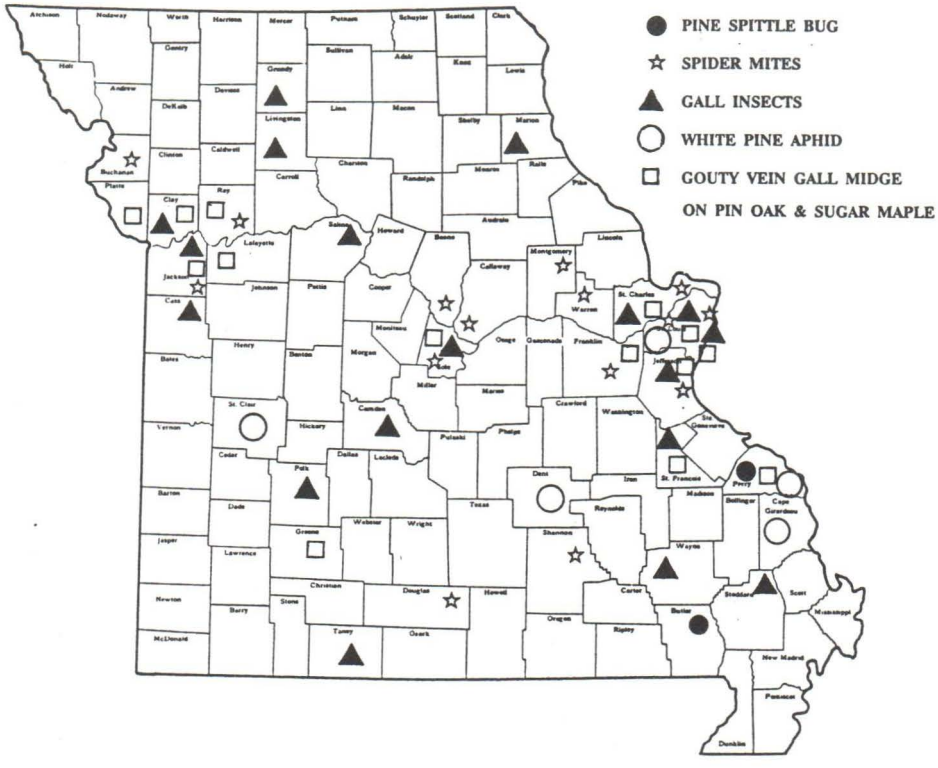
Trend - populations will be light to moderate in 1991.

Pales Weevil - populations were low in 1990. Infestations were reported from Adair and Jackson Counties. Pales weevil adults feed on terminal and lateral twigs at night causing flagging of the infested trees. Scotch pine is most affected however white pine can also be fed upon.

Trend - populations should be light in 1991.

Suppression - very little suppression work was conducted during 1990. Our standard control recommendation is to spray stumps produced during the previous Christmas season with thiodan and diesel fuel in March of the following year. Unless growers already have the problem, they usually do not take control measures to prevent possible weevil build-ups for the following year.





Pine Needle Scale - populations were moderate in scattered areas around the state, specifically in Butler, Buchanan, Franklin, Jefferson, Montgomery, St. Charles, St Louis City, St. Louis County, and Warren Counties in 1990. The scale feeds on needles of Scotch and mugo pines. Scales can build on needles in such large numbers that the plant appears to be whitewashed.

Small infestations should be controlled before the populations grow too large and difficult to control. There is always a potential for spread to surrounding Scotch pine trees. Although the pine needle scale is difficult to control, superior dormant oil can be used any time of the year and Sevin or Dursban can be used to control the crawler stage synchronized with the blooming of lilac in spring.

Trend - populations will continue to build, unless some natural biological control factor intervenes, infestations will increase in 1991.

Suppression - several Christmas tree growers sprayed individuals and groups of trees to control the pine needle scale in 1990.

Pine Webworm - populations were low in 1990. The pine webworm adult is a moth. The larvae feed on needles of shortleaf and Scotch pines creating a packed mud-like cluster on the top of the main stem. Defoliation occurs mostly on smaller pine trees which retards growth and causes an unsightly tree. Infestations occurred in Douglas, Howell, Iron, Reynolds, Ste. Genevieve and Wayne Counties in 1990.

Trend - populations will be light to moderate on scattered trees in 1991.

Suppression - certain Christmas tree growers will spray their trees with an approved insecticide.

Pine Tortise Scale - infested Scotch pine Christmas trees in plantations in seven counties in 1990. This insect is gradually becoming an important pest on Scotch pine. Control is difficult when an infestation has become established on five or more trees. Often, predaceous insects play an important role in controlling scale populations. Usually only trees five feet and taller are attacked.

An infestation can be detected by the presence of honeydew which has molded, imparting a gray or black cast to the infested portion of the tree.

Trend - populations should be light to moderate in 1991.

Suppression - Christmas tree growers were advised to spray dormant oil on only those trees infested prior to winter. If needed, growers will spray their infested trees in late May of 1991 with Sevin or Malathion to control the crawler stage of the scale.

Spider Mites - are normally a nuisance on various tree species in summer. Infestation was light to moderate over the state in 1990. Reports of damage were received in scattered counties around the state. Spider mites can be especially damaging to Scotch pine, baldcypress, Norway spruce, white pine, and Colorado and white spruce. Spider mites were more serious as in 1989. Conditions were good for development of spider mite populations. Feeding by spider mites produces a light-green, mottled color to infested needles. Upon closer examination, eggs, egg cases, webbing of adults can be observed on infested plant material.

Trend - populations should be moderate to heavy on plants scattered over the state in 1991. Although feeding seldom directly kills trees, it does stress them, thus damaging the aesthetic value of Christmas trees and ornamental plants.

Suppression - arborists use miticides to control the various species of spider mites. Christmas tree growers spray their Scotch pine trees for spider mites as the problem develops.

Forest and Shade Tree Diseases

Conifer Diseases

Atropellis Canker - is a common cause of branch tip dieback on shortleaf pine. Infections are most prevalent on lower branches and can be identified by the presence of red-brown needles that remain attached to branch tips. Sapwood infected by the fungus is stained a dark blue-black color.

Trend - the disease is widespread and endemic in the Ozarks. Infection becomes severe only when stand density increases.

Suppression - none

Brown Spot Needle Blight - continued to be the major disease of Scotch pine grown for Christmas trees. A wet May and June provided excellent conditions for brown spot infection this year. Infection of East Anglia, a long needled variety of Scotch pine was observed in one Christmas tree plantation. Ornamental Scotch pines are not seriously affected by the disease.

Trend - another wet spring in 1991 could result in a significant increase in the damage caused by brown spot in Christmas Tree plantations.

Suppression - most Christmas Tree growers apply chlorothalonil when needles are 1/2 full elongation and again at full needle expansion. Use of longer needled varieties of Scotch pine, particularly the Belgium variety, will greatly reduce brown spot problems.

Comandra Rust - is limited in distribution and was found only in Dent County on shortleaf pine. Distribution of the disease is apparently restricted by the alternate host of the fungus, bastard toadflax.

Stem cankers formed in the early stages of stand development can reduce stocking, but this is a rare occurrence.

Trend - the disease is not a threat to shortleaf pine regeneration because of the limited distribution of the alternate host.

Suppression - none

Diplodia Tip Blight - increased significantly in 1990 due to an unusually wet April. Infection by the fungus Sphaeropsis sapinea occurs during periods of wet weather and bud expansion and shoot elongation of pines. Damage from this year's infection will be more evident as the fungus moves into older branch tissues and branch dieback occurs.

Trend - levels of Diplodia blight are tied to weather conditions during bud expansion and shoot elongation. The fungus is widely distributed and causes significant damage to older Austrian pines.

Suppression - fungicide applications made during bud break and shoot expansion will control the disease.

Ploioderma needlecast - is widespread on shortleaf pine in the Ozarks and causes a premature browning and cast of two year and older needles. Although the disease is endemic, individuals of shortleaf pine vary greatly in their resistance to the disease. Symptoms initially appear in late winter and needles turn a straw to gray-brown color in the spring before being cast from the tree.

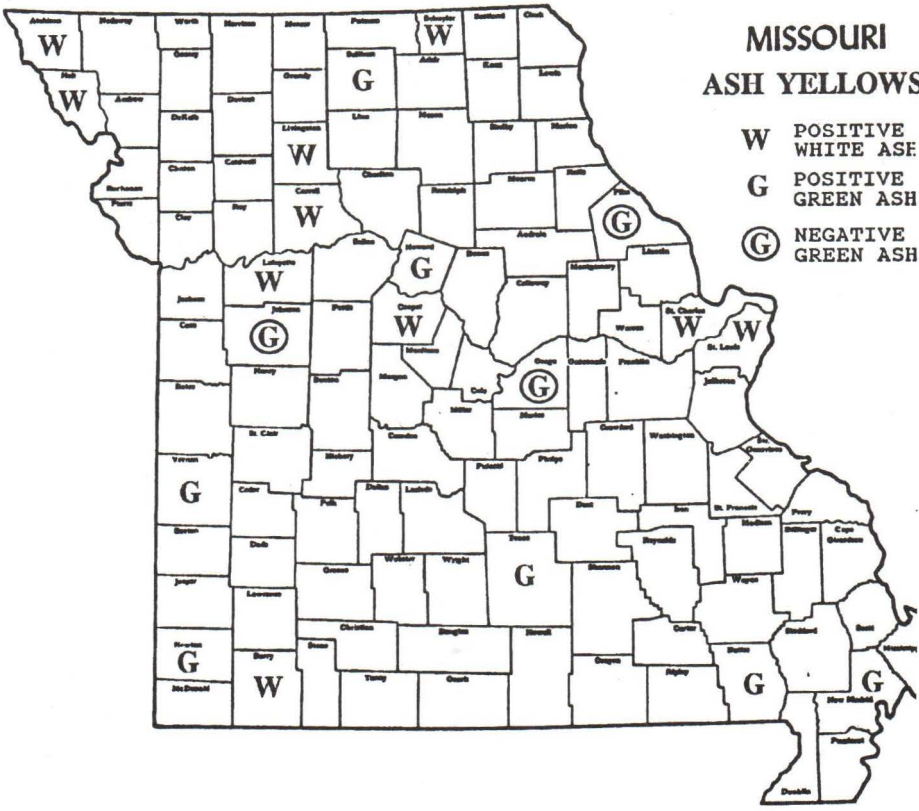
Trend - the disease is endemic although infection levels vary depending on weather conditions during infection periods in early summer.

Suppression - none

Western Gall Rust - has been positively identified in Boone and Lawrence counties on ponderosa pine and in Newton county on Scotch pine. Two additional Scotch pines in Jackson and Taney counties with multiple galls may be infected. Additional diagnosis to confirm the infection will be conducted in 1991.

Trend - no significant increase in the disease is expected, however other Scotch pine plantings in the state may be infected but have not been found.

Suppression - removal of infected trees where practical, is being practiced.



Hardwood Diseases

Ash Yellows - which is caused by mycoplasma-like organisms (MLOs) was found in 17 of 20 ash stands surveyed. All white ash stands (10/10) and 70 percent of green ash stands (7/10) tested positive for the mycoplasma based on a DAPI-DNA analysis of root tissues from the stands.

MAP

Trend - Ash yellows is widely distributed in both green and white ash stands in Missouri. The distribution of the disease in urban plantings has not been determined. No significant increase in the disease is expected, however, disease increase within infected stands will continue.

Suppression - None

Oak Decline - levels of oak decline did not increase significantly in 1990. Adequate rains throughout most of the growing season held the decline in check in most parts of the state. Trees on poor sites continued to die, although much of this mortality is most likely related to the build up of secondary pests on trees stressed during the drought of 1988.

Trend - oak decline is expected to level off if adequate moisture continues during the growing season. Periods of drought will lead to periods of increased decline.

Suppression - salvage cuts were made on stands with severe oak decline. Management guidelines to identify high risk stands are being developed.

Oak Wilt - continued at endemic levels in 1990 and caused most losses on large, valuable ornamental trees in urban areas. Pockets of oak wilt in forest stands were most prevalent in northern Missouri. A single salvage cut was conducted on the St. Joseph Forest District due to oak wilt in 1990.

Trend - no dramatic increase in oak wilt is expected in future years.

Suppression - severing root grafts, removing affected trees, and avoiding wounding oaks in the spring and early summer were recommended for oak wilt.

Conclusions

Above normal precipitation that covered most of the state provide good growing conditions and minimized the impact of most pest problems in 1990. Defoliation of sycamores by anthracnose, black walnut by the walnut caterpillar, and increased populations of fall webworm appeared serious but did not cause serious damage. We did, as expected, continue to see mortality of stressed trees in both urban and forested areas. Much of the mortality and decline is related to the increase in secondary pests after the drought of 1988.

We continued to actively survey for new and established insects and diseases this year. The Department provided support for the gypsy moth trapping program which has closely monitored the status of gypsy moth introductions. Only eight male moths were trapped this year. Survey for dogwood anthracnose, ash yellows, and commandra rust of shortleaf pine provided new information on the distribution and impact of these diseases.

There is heightened awareness of the importance and health of our forest and shade trees. Occasional outbreaks of pests such as insect defoliators, and the presence of dead and dying trees due to drought stress and overmaturity cause much concern to the public about the health of the forest ecosystem. A new federal program, known as Forest Health Monitoring, may be implemented in the future in an attempt to monitor the long term health of our forests and to standardize annual pest surveys. The program is contingent on federal funding.

We have been able to collect and assemble the statewide report on pest incidence and impact with the help of monthly reports provided by each Forestry District. Their cooperation with pest reporting, and interaction and help with pest problems on the District level has made this a successful program.

Insect-Host

Bagworm *Thyridopteryx ephemeraeformis* (Haw.) on assorted evergreens and certain hardwoods

Statewide

Black Turpentine Beetle *Dendroctonus terebrans* (Oliv.) on Shortleaf pine

Howell, Ripley, and Taney

Borers, Carpenter worm, red oak borer, *Goes sp.* on Hardwood Oaks

Boone, Buchanan, Butler, Carter, Dekalb, Dent, Howell, Iron, Jackson, Jefferson, Marion, Oregon, Perry, Reynolds, Ripley, Shannon,

St. Charles, St. Louis, St. Louis City, Stoddard, Stone, Taney, Texas, and Wayne

Bronze Birch Borer *Agrilus anxius* (Gory) on White Birch

Statewide

Catalpa sphinx *Ceratomia catalpae* (Boisduval) on Catalpa

Statewide

Cottonwood Borer *Plectrodera scalator* (F.)

Statewide

Cottonwood Leaf Beetle *Chrysomela scripta* (F.)

Statewide

Cottonwood Twig Borer *Gypsonomia haimbachiana* (Kft.)

Statewide

Two-Lined Chestnut Borer *Agrilus bilineatus* (Web.) on Oaks

Statewide

Twig Girdler *Oncideres cingulata* (Say) on Hickory and persimmon

Buchanan, Clay, Cole, Iron, Reynolds and Stoddard

Dogwood Sawfly *Macremphytus* (MacGillivray) on redozier dogwood

Cole

Eastern Tent Caterpillar *Malacosoma americanum* (F.) on (Prunus sp.)

Statewide

European Pine Sawfly *Neodiprion sertifer* (Geoff) on Scotch and mugo pines

Adair, Andrew, Atchison, Buchanan, Caldwell, Callaway, Cass, Clay, Clinton, Daviess, DeKalb, Franklin, Gentry, Greene, Harrison, Holt, Howard, Jackson, Jefferson, Lafayette, Lincoln, Nodaway, Platte, Ray, St. Charles, St. Louis, St. Louis City, Warren, Worth

Fall Webworm *Hyphantria cunea* (Drury) on black walnut, pecan, persimmon, hickory and assorted other hardwood species

Statewide

Gall Insects on assorted hardwoods

Statewide

Green Striped Maple Worm *Dryocampa rubicunda* (F.) on silver maple

Andrew, Atchison, Buchanan, Carroll, Clay, Clinton, Daviess, DeKalb, Gentry, Grundy, Harrison, Holt, Jackson, Lafayette, Livingston, Mercer, Nodaway, Worth

Gypsy Moth (in traps) six in St. Louis County and two in Crawford County

Ips pini (Say) on shortleaf and other pines

Cass, Dent, Franklin, Howell, Jackson, Jefferson, Reynolds, St. Charles, St. Louis, St. Louis City, and Wayne

Regal Moth *Citheronia regalis* (F.) on walnut

St. Louis and Cole

Imperial Moth *Eacles imperilis* (Drury) on hardwood foliage

Cole

June Beetle *Phyllophaga sp.* on oak

Oregon

Looper Complex on Hardwoods

Statewide

Nantucket Pine Tip Moth *Rhyaiconia frustrana* (Comst.) on shortleaf and Scotch pine

Cape Girardeau, Cass, Phelps

Obscure Scale *Melanaspis obscura* (Comst.) on pin oak

Carter, Cole, Franklin, Jefferson, St. Charles, St. Louis, St. Louis City

Pales Weevil *Hylobius pales* (Herbst) on Scotch pine

Adair and Jackson

Pine Needle Scale *Phenacaspis pinifoliae* (Fitch) on Scotch pine

Buchanan, Bulter, Franklin, Jefferson, Montgomery, St. Charles, St. Louis, St. Louis City, Warren

Pine Spittlebug *Aphrophora parallela* (Say) on Scotch pine

Perry and Butler

Pine Tortise Scale *Toumeyella numismatica* (P. & McD.) on Scotch pine

Buchanan, Cass, Dent, Greene, Jackson, Texas, and Wayne

Pine Webworm *Tetralopha robustella* (Zeller) on Scotch and shortleaf pines

Douglas, Howell, Iron, Reynolds, Ste. Genevieve, and Wayne

Poplar Tent Maker *Ichthyura inclusa* (Haldeman)

Statewide

Redheaded Pine Sawfly *Neodiprion lecontei* (Fitch) on shortleaf and Scotch pines

Bollinger, Carter, Douglas, Howell, Madison, Perry, St. Francois, Ste. Genevieve, Shannon, Stoddard, Taney, and Texas

Skiff Moth *Prolimacodes scapha* (Harris)

Cole

Spider Mites *Oligonychus spp. and Tetranychus spp.* on miscellaneous species

Statewide

Variable Oak Leaf Caterpillar *Heterocampa manteo* (Doubleday) on oaks

Cole, Lafayette, Madison, and St. Francois

Walnut Caterpillar *Datana integerrima* (G.&P.) on walnut, pecan and hickory

Statewide

Walking Stock *Diapheromera femorata* (Say) on oaks

Cole, Iron, and Reynolds

White Pine Weevil *Pissodes strobi* (Peck) on white spruce in Columbia--This is a record for Missouri

Boone

Yellownecked Caterpillar *Datana ministra* (Drury) on oaks

Adair, Clay, Cole, Jackson, Lafayette, Perry, Platte, St. Francois, Sullivan

Zimmerman Pine Moth *Dioryctia zimmermani* (Grote) on Scotch pine

Dent and Texas

Disease and Host

Actinopelte Leaf Spot *Actinopelte dryina* (Sacc.) Hoehn. on Pin Oak

Buchanan, Camden, Howell, Jackson, Jefferson, St. Louis,

St. Charles

Air Pollution Ozone (White Pine)

Cole, Howell, St. Louis

Annosus Root Rot *Heterobasidion annosum* (Fr.) Bref. on Shortleaf Pine

Wayne

Ash Yellows *Mycoplasmal* on Green and white ash

Atchison, Barry, Butler, Carroll, Cooper, Holt, Howard, Lafayette, Livingston, New Madrid, Newton, Schulyer, St. Charles, St. Louis, Sullivan, Texas, Vernon

Ash Anthracnose *Discula fraxinea* (Peck) Redlin & Stack on White and Green Ash

Adair, Andrew, Atchison, Boone, Caldwell, Carroll, Clay, Cole, Davies, DeKalb, Holt, Jackson, Jefferson, Lafayette, Mercer, Nodaway, Platte, Ray, St. Charles, St. Louis

Armillaria Root Rot *Armillaria mellea* (Vahl. Fr.) Karst. on Ash, Mockernut Hickory, Red Oak, White Oak

Clay, Franklin, Taney, Warren, Wayne

Atropellis canker *Atropellis tingens* Lohman & Cash on Shortleaf pine

Ozark Region

Brown Spot Needle Blight *Scirrhia acicola* (Dearn) Siggers on Scotch Pine

Boone, Cape Girardeau, Clay, Crawford, Hewell, Howard, Jackson, Pulaski, Ray, Taney

Cedar Apple Rust *Gymnosporangium juniperi-virginianae* Schw. on Apple, Eastern Redcedar

Statewide

Cedar-Quince Rust *Gymnosporangium clavipes* Cooke & Peck on Hawthorne

Boone, Callaway, Cole, Jackson, Greene, Stoddard and St. Louis

Comandra Rust *Cronartium comandrae* Peck on Shortleaf pine

Dent

Cyclaneusma Needlecast *Cyclaneusma minus* (Butin) Dicosmo, Peredot & Minter on Scotch Pine

Cole, Crawford, Howell, Shannon, St. Francois

Cytospora Canker *Cytospora kunzei* Sacc. on Blue Spruce, Norway Spruce

Howell, Jackson, Jasper

Diplodia Tip Blight *Sphaeropsis sapinea* (Fr.) Dyke & Sutton on Austrian, Scotch, Mugo, Ponderosa and Red Pine

Boone, Clay, Dallas, Howell, Jackson, Jefferson, Lafayette, Platte, St. Charles, St. Louis, Taney

Dothistroma Needle Blight *Dothistroma pini* Hul. on Austrian, Ponderosa Pine

Adair, Franklin, Jackson, Jasper, Jefferson, Marion, St. Charles, St. Louis

Drought Damage Various Hardwood and Conifer Species

Christian, Douglas, Howell, New Madrid, Ozark, Pemiscott, Stone, Taney

Dutch Elm Disease *Ophiostoma ulmi* (Buism.) Nannf. on American Elm

Atchison, Buchanan, Clay, DeKalb, Howell, Jackson, Jefferson, Lafayette, Maries, Pettis, Phelps, Platte, Polk, Putnam, Ray, St. Charles, St. Louis, Warren, Wayne

Eastern Gall Rust *Cronartium quercum* (Berck.) Miyabe ex. Shirai f. sp. sconatae on Shortleaf pine

Dent, Wayne

Elm Phloem *Necrosis Mycoplasmal* on American Elm

Sullivan

Fireblight *Erwinia amylovora* (Burr.) Winsl. on Pear, Apple, Crabapple

Cole, Howell, Wayne

Frost Damage on Redbud, Serviceberry, Maple and other hardwoods

Boone, Carter, Cole, Howard, Howell, Jackson, Oregon, Ripley, Shannon, Texas

Fusarium Canker *Fusarium solani* (Mart.) Appel & Wallenw. Emend Synd. & Hans. on Black Walnut

Howard, Wayne

Gnomonia Leaf Spot *Gnomonia caryae* Wolf on Hickory

Linn, Reynolds, Stoddard and Wayne

Hypoxylon Canker *Hypoxylon atropunctatum* (Schw. ex. Fr.) Cke. on Black, Chinkapin, Northern Red, Pin, Post, Scarlet, Shingle, White and Willow Oak

Butler, Franklin, Jackson, St. Charles, St. Louis, Warren, Wayne

Kabatina Blight *Kabatina juniperi* Schn. & v. Arx. on Eastern Redcedar

Butler, Jefferson, Ozark, St. Charles, St. Louis

Low Temperature Injury on English oak, Japanese Maple, Mulberry, Mimosa, Golden Raintree, S. Magnolia, Maple, Sweetgum

Cass, Lafayette, Newton, Perry, Phelps, Ray, Wayne

Maple Anthracnose *Aureobasidium apocryptum* (Ell. & Ev.) Herm-Nijh. on Sugar Maple

Boone, Callaway, Clay, Cole, Howard, Jackson, Lafayette, Platte, Ray

Oak Anthracnose *Gnomonia quercina* Kleb. on Bur, Post, Red and White oaks

Clay, Douglas, Howell, Jackson, Lafayette, Platte, Ray, St. Francois, Stone, Taney, and Wayne

Oak Decline Complex of abiotic & biotic factors on Black oak, Pin oak, Red oak, Post oak, Scarlet oak, White oak

Butler, Howell, Jefferson, Lincoln, Shannon, St. Charles, St. Louis, and Wayne

Oak Leaf Blister *Taphrina caerulescens* (Desmaz. & Mont.) Tul. on Red oak, pin oak

Cole, Crawford, Howell

Oak Wilt *Ceratocystis fagacearum* (Bretz) Hunt on Black oak, Red oak, Pin oak and other oak species

Adair, Atchison, Boone, Callaway, Cass, Crawford, Greene, Henry, Hickory, Howard, Johnson, Lincoln, McDonald, Montgomery, Shelby, St. Charles, St. Francois, St. Louis, Warren and Wayne

Peach Leaf Curl *Taphrina deformans* (Berk.) Tul on peach

Henry, Polk

Pine Needle Rust *Coleosporium asterum* (Diet.) Syd. on Shortleaf and loblolly pines

Douglas, Oregon, Reynolds, Taney, Texas and Wayne

Pine Wilt Disease, *Bursaphalenchus xylophilus* & (Steiner & Burher) Nickle on Austrian pine and Scotch pines

Boone, Cole, Howard, Jackson, Miller, St. Louis

Ploioderma needlecast *Ploioderma lethale* (Dearn.) Darber on Shortleaf pine

Wright

Rhizosphaera Needlecast *Rhizosphaera kalkhoffi* Bub. on Blue Spruce

Boone, Jefferson, Saline, St. Charles, St. Louis and Warren

Septoria canker *Mycosphaerella populorum* (Thompson) on hybrid poplar

Wayne

Slime Flux *Erwina spp.* on White, pin and shingle oaks; Elm

Clark, Phelps

Sycamore anthracnose *Discula platani* (Peck) Sacc. on American Sycamore

Statewide

Verticillium Wilt *Verticillium dahliae* Leb. on Catalpa, Sugar and Red Maple and Redbud

Atchison, Cooper, Greene, Howell, Lincoln, Texas, and Wayne

Walnut Anthracnose *Gnomonia leptostyla* (Fr.) Ces. & Den. on Black Walnut

Barry, Boone, Cole, Camden, Jasper, Lawrence, McDonald, Miller, Newton, Stone, Taney, and Texas

Western Gall Rust *Endocronartium harknessi* (Moore) Hiratsuka on Scotch and Ponderosa pines

Boone and Lawrence

Winter Burn and Drying on Austrian pine, Juniper, Holly, Magnolia, Loblolly pine, white pine, shortleaf and Scotch pine, yew, Northern White Cedar

Adair, Andrew, Barry, Barton, Buchanan, Caldwell, Cape, Girardeau, Clark, Cole, Crawford, Franklin, Gasconade, Jackson, Jasper, Lawrence, Lewis, Lincoln, Marion, McDonald, Monroe, Newton, Perry, Pike, Ralls, Shelby, St. Louis and Warren

Results Administrative Studies

Pine Wilt Disease Survey

A survey of older (15 year and greater) Scotch pine plantations and windbreaks for pine wilt disease was made again in 1990. The same plantations were also surveyed in 1988 and 1989. The survey was conducted in March to determine the yearly increase of the disease in Scotch pine. Trees were scored as healthy, infected in 1989 but not yet dead (Infected 1989) or killed by pine wilt disease in 1989 (Dead 1989). Results of previous years survey are also presented in table I. The categories listed above have a one year lag period (for example Dead 1989) because infection and mortality due to the disease occur the year before the field survey.

Table I - Pine wilt disease in Scotch pine plantations and windbreaks. Table headings are explained in text

Planting	% Healthy	%Dead 1987	%Dead 1988	%Infected 1989	%Dead 1989	% Dead	Total Trees
S. Short Plantation Cole County	75.2	9.4	3.2	0.6	0.8	10.7	497
N. Short Plantation Cole County	76.1	8.2	3.6	0.5	0.3	11.2	616
C-Highway Windbreak Moniteau County	80.5	8.1	5.7	3.8	1.2	0.6	159
I-435 Windbreak Jackson County	89.2	1.1	7.4	0.2	0.8	1.3	609
Average	80.3	6.7	5.0	1.3	0.8	5.9	470.2

Shortleaf Pine Disease Survey

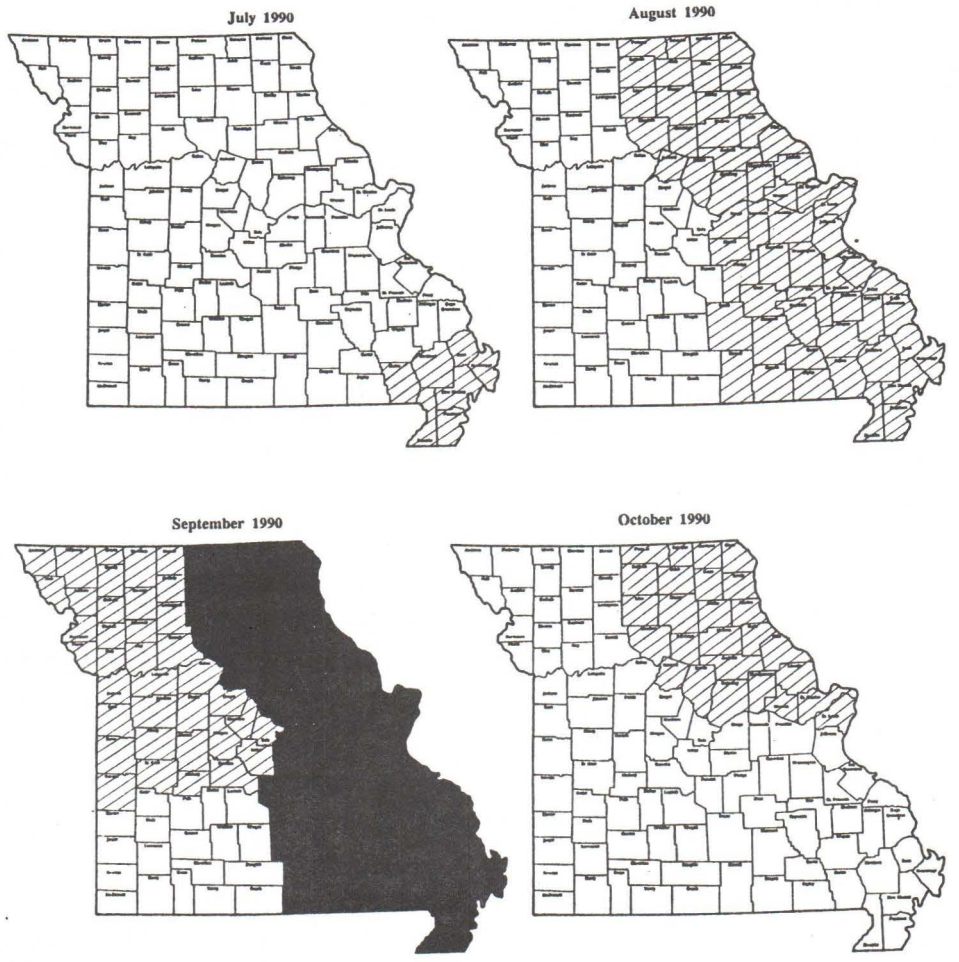
A survey of 44 shortleaf pine plantations between the ages of 5-20 years was made in the south central and south eastern Ozarks. The survey found the plantations to be in generally in good health. Comandra blister rust was found in five Forest Service plantations on the Salem Ranger District in Dent County. The rust was infecting between 5-30 percent of the saplings present in infected plantations. Eastern gall rust, pine needle rust, and ploioderma needlecast were found generally distributed throughout most plantations. Atropellis canker was prevalent in most plantings and was causing lower branch tip dieback. Some herbicide injury from the use of Velpar was found where it was used, and J-rooting and girdling roots were found occasionally. Insect problems were light and scattered with the pine needle aphid and pine webworm being present in a few plantations.

Dogwood Anthracnose Survey

Field survey for dogwood anthracnose was conducted again in 1990. Based on observations made in a survey conducted last year, selected locations were re-surveyed in both natural and ornamental dogwoods. The locations were mostly in the southeast portion of the state extending from St. Louis county south to the Bootheel region.

The wet spring should have provided excellent conditions for the development of dogwood anthracnose. Although symptoms of foliar disease were present, they were generally not typical of those caused by dogwood anthracnose. Septoria leaf spot, and large necrotic blotches due to Botrytis infection were the most common leaf diseases on the trees surveyed. Later in the season, interveinal browning was common on many trees urban trees. No pathogenic fungi were isolated from these spots which were most likely due to heat and moisture stress.

The survey again found that most dogwoods in the state are healthy and that dogwood anthracnose is not present in the locations surveyed. Health of dogwoods in urban plantings is more variable than that of natural stands because of the greater stress associated with urban environments.


July 1990
August 1990
September 1990
October 1990
Moderate Drought
Mild Drought
Near Normal or Moist
APRIL, MAY, JUNE NEAR NORMAL CONDITIONS

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